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EDITORIAL

Mr. Quezon, in a speech on the opening day of the Exposition, remarked that the better element of the Philippine youth should take the agricultural course. We sincerely appreciate the interest manifested by the great Filipino statesman in the development of Philippine agriculture; but with due respect to Mr. Quezon, we might bring out the point that, interpreting the phrase in general terms, a part of the better element of the Filipino youth have, fortunately, already advanced considerably in carrying this identical idea into practice. They have decided to embrace this profession, not only because of the possibilities in store in the Philippine soil, but also because they are conscious of their duty to their country in turning the natural wealth of our fields into active account and assisting to make our vast unproductive areas yield enough to meet at least the local demands for the necessities of life.

This College has among its students young men belonging to families of social prominence; they have left the greater comforts offered by their homes and are now serving as model examples to prove that real aristocracy consists, not in being distinguished from the rest of their kind by existing in a condition of social parasitism, but in pride of being self-dependent and rendering true service where service is most needed. We hope, however, that Mr. Quezon has not this class particularly in mind; we are rather inclined to construe the "better element" as meaning the entire force of young Filipinos who have the talent and the willing hands to carry them to the goal of their ambitions. We have at present about half a thousand of the latter class; they are being trained in scientific agricultural methods, and but a small part of the products of their work was represented by the materials displayed in the exhibition rooms during the Exposition. Six years hence, at the latest, this army of trained farmers will go out and will be ready to show their people what farming, based on the principles of modern science, can accomplish.

Five hundred, or even a thousand, scientific agriculturists will form an

exceedingly diluted leaven in the eight million inhabitants of the Philippine Islands. We therefore urge, with Mr. Quezon, that more of "the better element of the Philippine youth" come to the College of Agriculture, and that the Government so support this College that it will be possible to adequately train and equip all who may come.

A WORD OF THANKS

Thanks are due to President Quezon of the Philippine Senate, to Mr. Alunan (special representative of Speaker Osmeña at the Exposition), to the different members of the Legislature, to the directors of government bureaus, and to our colleagues of the Manila press for having honored our invitation to the Exposition and for their many encouraging speeches and editorials. We also thank the rest of the five thousand visitors for the outspoken general appreciation of the work of the College; and we hope they will not too soon forget the words of the Dean and of one of the students, that the Exposition is far from doing justice to the work of the College—that the real exhibit of the College is its Student Body.

Resolution of Gratitude

Whereas, Mr. Sixto Sandejas has voluntarily offered One Hundred Pesos (₱100) to the student ranking highest in the graduating class of 1917;

Whereas, Such an offer is the first of its kind in the history of the college;

Whereas, The gift will serve as a stimulus to students in their work, thereby serving to promote the cause of agriculture;

Be it resolved: That the Class of 1917 renders a vote of thank to Mr. Sandejas for his generous gift;

Be it further resolved: that this resolution be spread on the minutes of the Class of 1917 and that copies be sent to Mr. Sandejas, the Secretary of the University and the Dean of the College of Agriculture, and that it be published in THE PHILIPPINE AGRICULTURIST AND FORESTER.

The Class of 1917,

LEOPOLDO G. MENDOZA
President.

JOAQUIN J. GONZALEZ
Secretary.

Field Production of Yautias, Gabis and Dasheens

By Gerardo O. Ocfemia

Thesis presented for graduation from the College of Agriculture, No. 46

INTRODUCTION

The yautias,[1] gabis or taros,[2] and dasheens[3] are among the oldest of the cultivated plants. The enlarged portions of the underground stems are edible. People throughout the tropics and semi-tropics use the rhizomes of these plants or of some members of the Araceae in greater or less quantity for food, in much the same degree that the Americans and Europeans use the potato. Though so widely used, the farmers of Porto Rico and Hawaii are the only ones, so far, who have done experimental work with fertilizers and methods of cultivation, as applied to yautias and gabis. Even in Porto Rico and in Hawaii, this important work is done not on the initiative of the people but on that of the agricultural experiment stations. In other places where these plants are raised the farmers are satisfied with what they obtain from their fields by the most primitive methods of cultivation. In fact, there are fields, as in Hawaii, where gabis have been grown for about 200 years continuously. In these fields a very serious deterioration of these plants has been observed. For this reason, the Hawaii Agricultural Experiment Station performed experiments in which manures and other fertilizers were applied to the soil.

It is the aim of the present study to find out how the yautias, gabis, and dasheens behave under different conditions of field cultivation. Emphasis is laid on production. Such recommendations for culture are made as may enable our Philippine farmers concerned in this industry to get a better return from the land, with the same amount of expense, labor and effort.

METHODS OF CULTIVATION IN DIFFERENT COUNTRIES

Regarding yautias in Porto Rico, the chief source of information is O. W. Barrett, *The Yautias of Porto Rico* Porto Rico Agr. Exp. Sta. Bulletin 6, 1905. According to Barrett, yautias can be grown anywhere in the tropics and semi-tropics, where frosts do not occur. There is probably no other plant which can be raised under so wide a range of conditions as these. They require for their normal growth and development an ample supply of moisture, and the ideal place for tuber formation is a deep mellow soil, preferably sandy loam with abundant food. The soil must be well drained, although there should be enough water to supply the plants with all that they need.

No rule can be given for the distances of the spaces between the plants in a row or the distances of the rows from each other. This is usually determined by the kind of soils and the variety of yautia to be raised. For medium-sized varieties it is said that from 20,000 to 25,000 plants can be planted in one hectare.

In Hawaii the people grow the taro extensively. There are two general types of the plant in cultivation. One of these types grows partly submerged and for this reason it is known as water taro. The other type, known as dry-

1 The yautias (*Xanthosomas*) have sagittate leaves. (Sheaths proportionally longer than free portion.)

2 The taros or gabis (*Colocasia esculentum* Schott) produce runners about a foot long, usually tuberless. Leaves peltate.

3 The dasheens (*Colocasia* sp.) produce no runners but have many sprouts which appear either from the main root-stock or from the side tubers. Leaves peltate.

The use of these names in the sense of these definitions follows the usage of the United States Department of Agriculture. *Taro* is an Hawaiian word and *gabi* a Philippine word; both used in the original tongues without regard to the formation of runners; that is, to include the dasheens.

For detailed description of each and its varieties see Quisumbing: "Cultivated Root-Producing Aroids," *The Philippine Agriculturist and Forester*, Vol. III, Nos. 4 and 5, 1914.

land taro, grows in the uplands. The latter variety is not submerged, but grows on moist hillsides and valleys well drained, but still too wet for other crops.[1]

The soil for the water taro should be heavy and capable of retaining water. Mucky soils in the bottoms of valleys are usually selected. The valley bottoms of Hawaii are often laid out in taro patches which vary greatly in shape and in size, no two being alike. They are so arranged that the water will pass over the higher patches to those below. Mountain streams on their way to the sea are thus diverted into these patches.

The method of preparation of taro patches is very similar to that employed in the Philippines in making rice paddies; in fact they use the same method for these two crops, they being interchangeable on the same land.[2]

As dry-land taro does not really grow in a dry soil, it might be more correct to call this type upland taro. It requires an ample supply of water and is, therefore, cultivated in places where the soil is always moist, as in the valleys and on the hillsides or where there is an abundant rainfall throughout the year. The soil must be properly drained, but contain plenty of water for the normal development of the plant. It must be plowed deeply, harrowed and furrowed into rows about 90 centimeters apart to give ample space for cultivation.

After the taro is planted, the only work required of the owner is a little weeding with a hoe. The dried leaves are pulled off and the weeds cut down and buried in the soil as fertilizer. The people do not use animals in cultivating their fields. The most important work done is to keep the water running continuously or to change it frequently.

The taro matures in 13 to 15 months, according to the variety.

The raising of taro in Hawaii is a very important occupation. The people, especially the poorer classes, depend almost wholly upon this crop for their maintenance. Statistics show that about 80 percent of the poi is produced by the Chinese.

Taro land in Hawaii rents at from $100 to $125 per hectare a year. The yield per hectare ranges from 15 to 25 tons. The taro sells at from 3 to 12 cents per kilo.

The value of the annual production of taro in Hawaii is estimated roughly to be from $100,000 to $150,000.

In New Caledonia, Tahiti and the neighboring islands and in Malaysia, the planter selects for taro land which is too wet for other crops, giving preference to swampy or muddy places. The soil is first drained. As in Hawaii, the people plant the tops of the rhizomes, leaving a portion of the petiole attached.[3]

The dasheens,[4] in their soil requirements, are like the upland taro in Hawaii. Their optimum development is attained when planted in rich but well drained, moist, sandy-loam soil. If flooded for a considerable length of time they are greatly injured. In the Southern United States, it is said that the Hammock Lands of Florida are especially adapted for the growth of these plants. It is further said, that this crop is suited to any low-lying sand lands which are too wet for other crops, provided these lands are well drained. It is recommended that whenever planting is to be done on these lands they be set in ridges in order to drain off the waters.

[1] Cycl. of Am. Agr., Vol. II, pp. 629-630.

[2] An. Rept. of the Hawaii Agr. Exp. Sta., p. 376, 1901.

[3] P. Sagot et E. Raoul: *Manual Practique des Cultures Tropicales*, p. 79.

[4] Robert A. Young: *The Dasheens, A Root Crop for the Southern States.* Cir. 127, Bu. Pl. Ind., U. S. D. A., pp. 30-31, 1913.

Experience, confirmed by experimentation, shows that for dasheens, as well as for the taros and the yautias, the use of small plants for propagation is not advisable. It is recommended to use for this purpose only the tops or the larger tubers. It is, therefore, suggested that tubers weighing from 75 to 150 grams be used. In general field planting, if the tubers be not very large or very small, they are set singly and entire.

They are placed in hills from 6 to 9 centimeters deep and about 90 centimeters apart. The distance between the rows is generally 1.2 meters. This space will allow horse cultivation. During the summer months the soil is frequently cultivated to keep the weeds down and at the same time to throw the earth toward the bases of the plants, so that in the end, the rows are long ridges. This has an advantage in that it enables the plant to form larger and more numerous tubers. Once the plants are large enough so that their leaves shade the ground, very little cultivation is needed. At about the middle of the summer season, the well grown dasheens attain a height of from 1.4 to 1.8 meters.

Unlike the taros and yautias, the dasheens mature in about 7 months. For home use, however, tubers can be dug from the field as early as the sixth, or even the fifth, month from the time of planting.

It is claimed that the growing of dasheens is no more expensive than the growing of the potato. Although the growing season is longer than that of the potato, the larger leaves of the former keep down the weeds by shading, and for this reason less labor is required for weeding.

FERTILIZERS

Yautias.—Root crops that give very heavy yield require a very rich soil, because they are gross feeders. Lack of this soil character results in a very noticeable reduction in yield. If the physical condition of the soil be not good, it can be improved by means of various manures and fertilizers.

Experiments carried out at the Porto Rico Agricultural Experiment Station (Barrett, l. c., p. 20) showed that the yautias utilize nitrogen most readily in the form of ammonium salts. Nitrogen in the form of nitrates tends to produce heavy tubers of enormous size but low in carbohydrates. That the form of nitrogen that this plant assimilates is like the form that the rice uses is evident from the fact that the water forms can be planted interchangeably with rice in the paddies. So far the Porto Rico Station has found that stable manure is the best to use in connection with this crop. An application of manure at the rate of about 20 tons to the acre, yielded about 20 tons of tubers, against the control which gave only 10 tons to the acre. Composted coffee pulp applied in the hill gave a yield of 12.4 tons to the acre, while a complete fertilizer applied broadcast before planting gave a yield of only 11 tons, which goes to prove the economy and superiority of using stable manure with yautias.

Taro.—In order to determine the relative economic value of fertilizers in their various proportions and mixtures, the Hawaii Station[1] began a series of experiments on taro in August, 1910. These experiments were carried out with the co-operation of the Kalihi Poi Factory and upon their land. The results they obtained, although carried out during one growing season only, have proved to be of great practical value to the taro growers and of no little scientific value.

1 1912 Ann. Rept. Hawaii Agr. Expt. Sta., pp. 56-58.

The results show the economic value to be derived from ammonium sulphate, superphosphate, and sulphate of potash, which they applied at the rate of 336.12 kilos, 504.18 kilos and 448.16 kilos per hectare, respectively.

They also found that the nitrates tend to produce larger and heavier tubers, which lack, however, considerably in the amount of carbohydrates. The rate at which they applied the nitrate of soda was 448.16 kilos to the hectare; and in combination with 504.18 kilos of superphosphate and 448.16 kilos of sulphate of potash. Within certain limits, the time of application of fertilizers does not affect the yield.

Dasheens.—According to Young,[1] the Porto Rico Agricultural Experiment Station found that ordinary stable manure is better to use in connection with the dasheens and their relatives than are commercial fertilizers. In cases of soils deficient in potash, however, they recommend the use of fertilizer rich in it, to be applied at the rate of 672.24 kilograms to 1120.39 kilograms to the hectare, the amount depending upon the fertility of the soil. It is to be applied a few weeks after planting; and if desired, another application can follow.

PRODUCTION RECORDS IN OTHER COUNTRIES

In the United States it is said that, in 1912, a total yield of about 140 hectoliters per hectare has been obtained.

In Barbados,[2] where 29 varieties of Colocasias introduced from Porto Rico have been used, yields ranging from a total failure to 3,495.54 kilograms per hectare have been obtained.

In Hawaii, in connection with their fertilization experiments with taro, the highest yield of 1,961.71 kilos per hectare was obtained from the application of 448.16 kilos of nitrate of soda 504.18 kilos of superphosphate and 448.16 kilos of sulphate of potash per hectare. A greater amount of carbohydrate content of the tubers was obtained from the substitution of ammonium sulphate for nitrate of soda, the former applied at the rate of 336.12 kilos per hectare.

Sagot and Raoul quote a yield of from 1 to 2 kilos of tubers of Colocasia per hill.

Barrett says that in Porto Rico a single plant may yield as high as 2.79 kilograms. However, for ordinary varieties grown in ordinary soils, at the rate of about 10,000 plants per hectare, Barrett says that the yield may range from nine to thirteen and one-half tons per hectare.

PRESENT EXPERIMENTS

The main object of the present work in connection with these crops was to study field technique. A large number of varieties of yautias, gabis, and dasheens were taken over from F. A. Quisumbing in the latter part of January 1914. The following outline was the guide in the work:

I. Plant all varieties represented by but few plants in deep furrows one meter apart.

II. Divide larger lots for culture, comparing:
1. Irrigated and unirrigated.
2. Fertilized and unfertilized.
3. In open field and as intercrop.
4. In deep furrows and in ridges.
5. On old fields and in new ground.
6. In open field and following rice in paddies.
7. In open field and in uncleared and uncultivated caiñgin.

The first planting was begun between January 27 and 29, but on account of the unfavorable season, it was not possible to start all the different cultures. On account of the inadequate water supply for irrigation, it was not possible

[1] *Promising Root Crops for the South*, Bull. 164, Bu. Pl. Ind., U. S. D. A., 1910.

[2] J. R. Borell: (*Expt. with Field Crops*, Barbados, 1908-1909) Imperial Dept. of Agr. West Indies, Report Local Dept. of Agr., Barbados, 1908-1909, pp. 2-13. (Expt. Sta. Record, Vol. 23, No. 4, 1910, p. 334.)

to continue planting, excepting after occasional rains. Plantings made during this time had to be replaced in spite of the heavy mulching, on account of the drought which then prevailed.

It was found that the yautias can resist unfavorable weather conditions better than can gabis and dasheens.

Planting as an intercrop, if the shade is too dense, is not advisable.

Planting in deep furrows during the dry season is preferable to planting in ridges.

The yautias, gabis, and dasheens do well in new ground, the yautias especially so, although cogon[1] soils are said to be deleterious to many farm crops.

In rice paddies, if the water is to remain above the surface for a considerable length of time, the water form of gabis is to be preferred to the yautias and dasheens. The yautias and dasheens will do well in well drained soils, if the latter are moist enough for other crops.

Planting in the open, if the irrigation can be kept regular, is more advisable than planting in an uncleared and uncultivated caiñgin; in the latter, these plants tend to develop wide leaves and long slender petioles, at the expense of the tubers.

FIELD MANAGEMENT AND OBSERVATIONS

In order to have enough seed to plant in the different plots, the tubers of yautias, gabis, and dasheens and the root-stocks of the former were cut into as many pieces as there were offshoots. These offshoots were allowed to begin their development during the dry summer months, in nursery beds, where they could be watered regularly, so that by the time the favorable season came, they were well started and large enough to handle readily. When starting a plantation on a commercial basis, this, of course, should never be done, because the yield is diminished considerably by using the offshoots from the rootstock or even side tubers which weigh less than from 85 to 150 grams. According to Young, the yield in this case may decrease as much as 15 percent. Where the three sources of seed, namely the upper portion of the madres, the tubers and the lower portions of the madres were compared, the greatest yield was produced where the upper portions of the madres were used.

As to the behavior of the different cultures, only the plants in the (1) two lowermost paddies, (2) the plot in which the different varieties were planted, (3) the plot planted to variety 309, Rolliza Blanca Yautia, (4) those in the new field, (5) fertilized plot and (6) irrigated plot were vigorous in their development and attained a considerable size; although the plants in the new field, fertilized plot and irrigated plot were propagated by cuttings. This was due to several causes, two of which are: the natural tendency of offspring to be small when their parents are small, and the unfavorable planting season.

In the Philippines, the gabis and yautias should be planted during the season from January to March or as early as the beginning of the dry season, provided the soil can be irrigated to start the plants. It has been observed during the progress of this work that, as a rule, the yautias are most resistant to adverse climatic conditions, remaining dormant during the hot months and awakening when the first rains come. The dasheens, once started in their development and their roots formed, are only slightly damaged; while the gabis suffer various sorts of trouble due to the dry season. Moreover, the soil ought not to be a heavy clay, but

[1] *Imperata exaltata* and *I. cylindrica.*

a deep, mellow, rather sandy loam with abundant plant food; and irrigation should be resorted to during the dry months. The farmer should be careful to select his seeds only from the heavy yielding varieties, and to use only the upper portions of the madres in yautias and the central plant in the case of the gabis and dasheens.

When gabis and yautias are planted only at the beginning of the wet season, as was done on most of the plots in experiments noted in this work, the development, as well as the yield, is not normal, as can be seen from those cultures mentioned, because the plants were hardly well started when the wet season ended, and the dry season following retarded their progress very noticeably. As has already been noted, in the case of variety 309, Rolliza Blanca Yautia, which was planted in February, those in Plot II, which were planted in April, and in the two lowermost paddies, which were planted in February, produced plants of normal size, or in some cases much larger, because they had time during the dry season to start their development. The result would have been more marked had it been possible to irrigate those plots more frequently during the dry months.

A month after planting, the plot intended for studying the effect of fertilization was fertilized with a complete commercial fertilizer. In this experiment it was not intended to compare the value of different fertilizers and manures in their different proportions and mixtures but merely to compare the produce obtained from an ordinary fertilized and a control plot. For this reason, the formula expected to give the highest results as regards weight and volume of the tubers was chosen. Such a formula was N-3, P-7, and K-10. Nitrogen was applied in the form of nitrate of soda. The potash and the phosphorus were applied two weeks later, to prevent the decomposition of the former. This nitrate of soda contains approximately 15 per cent of nitrogen. Phosphorus was applied in the form of single superphosphate, and potash in the form of sulphate of potash; the latter containing approximately 50 percent of water-soluble potash. The rate at which the fertilizer was applied was 469.77 kg. of sulphate of potash to the hectare, 1106.85 kg. of superphosphate soda per hectare and 437.03 kg. of nitrate of per hectare. The fertilizer was cultivated into the soil close to the rows on both sides of the plants. The effect of the fertilizer could be seen during the second month. At this time all the plants in this plot were more than twice the size of those in the check plot. The plants in the latter plot not only had smaller leaves, but fewer of them. The rate of growth in the fertilized plot was comparatively great, while it was slow in the control plot. The color of fertilized plants was healthy green, except variety 436, Punyera Yautia, which was rather pale green although the leaves were very large and the whole plant of good size. Variety 1521, San Fernando Po, although it had good-sized petioles, produced small, wrinkled leaf blades. This probably was not due to the effect of the fertilizer applied, because the same behavior was exhibited by this variety in the irrigated plot.

Irrigation was only frequent enough to keep the soil moist and the plants fresh, except near harvest time. It was observed in irrigated plots, that although irrigation had not been very frequent, the plants were almost twice as large as those of the control plot. The difference was very pronounced during the dry season. The leaves of those less frequently irrigated (control) turned yellowish, and later died; while those of

the irrigated plots remained fresh and darker in color, and continued to increase in size.

Field observations show that in deep shade, as between the bananas and in the caiñgin,[1] the plants do not increase normally in size but are dwarfed. Some of those planted in the caiñgin, especially those in the open part, tended to produce long and slender petioles, with broad leaf blades, at the expense of the tubers.

The yautias which grew to a height of two meters in the lower paddies were enormous in size and in weight. From the diggings made November 5, 1914, at the age of ten months, it was found that the tendency of the yautias is to produce very heavy madres with a few comparatively small tubers. Variety 309, Rolliza Blanca Yautia, gave an average from three plants of as high as 4.00 kg. of madres and only 0.3 kg. of tubers; 430, Malanga Yautia, 4.2 kg. of madres and only 0.54 kg. tubers; 1720, unknown yautia, 1.45 kg. of madres and 0.89 kg. of tubers; and 912 gave 2.69 kg. of madres and no tubers. Fair averages could not be secured because this plot was considerably damaged by wild hogs, which destroyed most of the yautias and all of the gabis.

Planting in ridges is only advisable in places where the water is very near the surface of the ground. Planting in deep furrows is more beneficial in places where the water is rather scarce, since by turning the soil over the furrows its moisture can be conserved. In wet places, planting in ridges will help the plant to produce more numerous and larger tubers, because the soil is loose; and the harvesting of the crop is much easier if the plants are in ridges. Plants, however, may suffer very greatly during the dry season if they are planted in ridges, because by ridging the soil the surface is greatly increased and the water level lowered.

The yautias in the new field were very luxuriant; in fact they were as large as those in the irrigated plot. However, as this field could not be irrigated, the dasheens and the gabis could not stand the drought. Much damage was done to this plot by wild hogs when the tubers were already formed; and for this reason, no fair estimates as to yield could be obtained from the plants. Judging by color and size, it would seem that these plants will give very good results on such ground. It should be remembered that this patch of ground was previously covered with cogon, the deleterious effects of which on the soil are well known.

The plants in the old and new fields had almost the same development. They were far behind and, consequently, were smaller than the rest of the cultures excepting those in the densely shaded banana rows and in the caiñgin.

Although the damage as a whole is only very slight, the larvae of a sphinx moth[2] defoliated the gabis in some instances completely; the dasheens were only slightly damaged and the yautias not at all. Aphids abound on the gabis, but do not do much damage; moreover, they are held in check by certain natural enemies. Mealy bugs, although they do not cause any serious effects on yautias, so far as could be observed, spread throughout the different cultures, although they did not affect the gabis and dasheens.

It was further noticed that although wild hogs destroyed the gabis and yautias completely, they passed the dasheens by untouched. For places where wild hogs are common it seems advisable to use the dasheens for planting, otherwise fencing the plantation will be necessary.

1 A new and imperfect clearing.

2 *Hippotion celerio* Linn.

RESULTS

The figures of yields are low. This is due to various causes, most of which have already been mentioned. It should be remembered that the yields per hectare for all the varieties of yautias, gabis and dasheens have been calculated on the basis of 10,000 plants. Barrett calculated his yields of yautias on the basis of from 8,000 to 10,000 plants per acre, making the number 2½ times larger. Dasheens planted 3 feet by 4 feet (Young's figures) would have 3,626 plants to the acre. Taro is planted in Hawaii at a distance of 1 foot by 3 feet. These numbers correspond to 16,960 to 21,200 plants per hectare in the case of yautias, 8,958 in case of the dasheens, and 29,680 plants to the hectare in the case of the gabis.

It will also be noticed that in calculating the yield of the yautias the weights of the tubers and the madres are dealt with separately, because in yautias only the tubers are good for table purposes. The entire rhizome of the gabis and dasheens is edible and for this reason the weights represent the weight of the entire hill minus the stem.

By using for seed the upper portions of the madres, the tubers and the lower portions of the madres, there is a great variation in yield. When the upper portions of the madres are used for seed, the following figures are the gain over the other portions of the plant:

	Upper portions of madres over tubers	*Upper portion of madres over lower portion*	*Tubers over lower portion of madres*
	Kg.	Kg.	Kg.
Tubers alone per hectare	4,644	12,270	7,626
Madres alone	7,735	1,000 less	6,735
Tubers and madres together	12,375	13,266	891

Thus, it will be seen that there is a very marked advantage in using the upper portions of the madres for seed, and the preference of the larger size of tubers in case of lack of madres over the offshoots of the lower portion of the madres.

The average yields of the different varieties in a culture are such as one would expect from a common farm. The yautias, as well as the dasheens, vary greatly in the yield of the varieties. Of the yautias, varieties 444, Rolliza Yautia; 439, Trinidad Yellow Yautia; 430, Malanga Blanca Yautia; and 309, Rolliza Blanca Yautia, gave yields ranging from 20 to 30 tons of madres and tubers together, being 29,096 kilograms; 27,566 kilograms, 21,700 kilograms, and 20,742 kilograms per hectare, respectively. The following varieties yielded from 10 to 20 tons to the hectare:

	Kilograms
436—Punyera Yautia	10,730
443—Grey Jack Yautia	10,450
440—Prieta or Morada Yautia	11,290
589—Unknown Yautia	14,100
587—Unknown Yautia	17,000
1521—San Fernando Po Yautia	18,130
588—Unknown Yautia	18,962

The above varieties are, therefore, recommended for distribution because they are heavy yielders and can be raised profitably by the native farmers with the common method of cultivation.

Varieties whose yields were less than 10 tons to the hectare are not mentioned above.

The Colocasia variety 2324, from the Bureau of Agriculture, is an exceptional yielder, giving an average yield of 1.20 kilograms per hill or 12,000 kilograms to the hectare; and variety 1854, an unknown variety, yielded 13,200 kilograms per hectare. In this culture consideration should be given only to those varieties that have given yields of 8 tons to the hectare and upwards. Such varieties can be recommended for culture by the native farmers. They

are listed below, with the computed yields in kilograms per hectare opposite each:

	Kilograms
102—Gabi, Smooth Black	9,200
310—Gabi, Rough Samar	8,000
431—Dasheen, White Edda	5,971
437—Dasheen, Unknown	9,000
495—Dasheen, Mindoro	8,444
585—Dasheen, Unknown	8,662
945—Dasheen, Puti (White)	8,700
947—Dasheen, Lasuna	5,200
950—Dasheen, Malabong Puti	8,200
1055—Gabi Siniñora	5,000
1641—Dasheen Sinibuyas	5,350
1637—Colocasia sp.	5,100
1852—Dasheen, Unknown	9,260
1844—Colocasia sp.	6,600
1846—Colocasia sp.	6,530
2592—Gabi Surigao	5,200
912—Undetermined	8,000
547—Undetermined	8,500

Most of the varieties are very promising, and the fact that very few appear in the above list is because many are late varieties and need more time to complete their development. The varieties that are listed above, with the exception of the wild forms, are early ones, especially the dasheens. They can be recommended for distribution and for cultivation, since they are good yielders. The yautias in these cultures are only nine months old, while the gabis are most of them seven months old. The dasheens are fully matured at seven months, after which, if not harvested, they send new plants from the eyes of the tubers formed.

In an experiment on the effect of irrigation on the yautias, gabis and dasheens, the plants were harvested at the age of nearly 10 months. All of these plants came from but a few rootstocks and tubers through cuttings. Still we find yields of over five tons to the hectare; and in case of the yautias yields have been obtained as high as 19 and 21 tons per hectare; while the same plants cultured in a rather dry soil failed entirely. Of the dasheens, varieties 435 and 1641, and of the taros, 1056, gave yields of 7,250, 7,160 and 7,400 kilograms per hectare respectively.

Comparing the yield of the different varieties the following increases per hectare are found to result from irrigation:

EFFECT OF IRRIGATION

Variety No.	*Difference in favor of irrigation Kg.*	*Variety No.*	*Difference in favor of irrigation Kg.*
435	4,850	1056*	7,400
495	950	1637*	3,400
1849	620	947*	1,800
102	3,300	309	6,980
437	1,475	1521	4,950
944	1,740	430	2,150
433	1,172	444	3,225
1641	5,490	436	4,040
308	1,500	538*	19,600
950	2,080	443*	21,800

* These varieties died where unirrigated.

It is probable that 495 and 1849 are not water forms; but in all cases the plants of these plots have shown an increased yield if water is supplied to the roots. In this connection one will see the advisability of frequent and regular irrigation in connection with this crop.

Fertilization may considerably increase the yield of all yautias, gabis and dasheens. The plot used for this experiment was 56 meters by 7 meters, or approximately one twenty-fifth of a hectare.

The following table shows the difference in each variety of yautias, gabi and dasheens in favor of the fertilized plants. The weights are expressed in kilograms per hectare on the basis of 10,000 plants to the hectare, and are written opposite the variety numbers:

EFFECT OF FERTILIZATION

Variety No.	*Difference in favor of Fertilized Plants Kgs.*	*Variety No.*	*Difference in favor of Fertilized Plants Kg.*
585	5,324	945	5950
435	5,100	1637	3450
495	7,230	1056	7100
1849	5,930	947	3000
102	5,886	309*	4700*
437	3,635	1521*	5012*
1641	5,479	430*	3720*
944	5,087	444*	7900*
433	4,766	436*	3700*
431	4,073	588*	4522*
308	3,690	443*	4188*

* Tubers only considered; madres not included.

The fertilizer given was about 190 kilograms of sulphate of potash, 454 kilograms of superphosphate and 177 kilograms of nitrate of soda per hectare. The cost of the fertilizer is ₱15.50 per 100 kilograms of sulphate of potash; ₱5.20 per 100 kilograms of superphosphate, and ₱16.00 per 100 kilograms of nitrate of soda. The cost of transportation is ₱7.00 for 6,000 kilograms. At this cost and at the above rate of application, it would cost a farmer for each hectare of land ₱28.64 for sulphate of potash, ₱22.73 for single superphosphate and ₱10.64 for the nitrate of soda; or as the total purchase price of fertilizers, ₱62.01. The cost of transportation is about ₱0.99. Not including the cost of application, the total cost of fertilizing a hectare would be ₱63.00.

At the rate of from 2.5 to 5 centavos per pound of taro (the Hawaiian price), or 6 to 12 centavos per kilo, and the Porto Rican price of about 1 cent a pound of yautia tubers, or 4 centavos a kilo, we have the following calculations of the cost of the different varieties. These figures are based on the increase in yield due to the fertilizer, as shown in the preceding table. As no price is given for the dasheens, the calculations have been based on the price of the taros:

Variety No.	*Variety Names*	*Selling price of tubers in a Ha. of fertilized land. *₱0.06 per Kg.*	*Selling price of tubers in a Ha. over the unfertilized land. *₱0.06 per Kg.*
	Taros and Dasheens....	.....	.....
585	Colocasia, unknown...	₱526.80	₱319.44
435	Dasheen Puti.....	450.00	300.00
495	Dasheen Mindoro.....	544.80	433.80
1849	Dasheen.....	474.00	355.80
102	Gabi, Smooth Black...	257.16	233.16
437	Colocasia, unknown...	303.60	218.10
944	Dasheen Malabong pula.....	362.22	305.22
433	Dasheen Kelly No. 16.	483.96	285.96
1641	Dasheen Sinibuyas....	419.40	328.74
431	Dasheen White Edda..	336.20	244.38
308	Dasheen Los Baños....	330.00	221.40
945	Dasheen Puti, Morong.	403.80	357.00
1056	Gabi Manalod Pula...	450.00	207.00
1637	Colocasia sp.....	303.00	426.00
947	Dasheen Lasuna.....	252.00	180.00
	Yautias.....	*0.04	*0.04
309	Rolliza Blanca yautias.	820.00	188.00
1521	San Fernando Po.....	466.96	200.48
430	Malanga Yautia.....	366.40	148.80
444	Rolliza Yautia.....	496.00	316.00
436	Punyera Yautia.....	352.00	148.00
588	Unknown Yautia.....	460.80	180.88
443	Grey Jack Yautia.....	484.00	167.52

* Harvested at the age of 7 months. Only the dasheens are matured. The selling price of yautias is based on the tubers alone.

NOTE:— ₱1.00 = $0.50 United States Currency.

It will be noted that the price taken has been that from other countries, which may be rather too high for Philippine markets. It would, however, pay even if the price were reduced 50 percent. Even after taking into consideration the cost of application, it is still to the advantage and profit of the farmer to fertilize. This does not mean, necessarily, that we recommend commercial fertilizers. It remains to be determined if the farmer could not get nearly as good results by the use of various forms of natural manures that are readily accessible to him and much cheaper than commercial fertilizers.

A comparing of plants in the open and between rows of banana is not reported in detail, because of general failure between the bananas. The yautias and a few of the dasheens lived, but even these were only about half as large as the plants in the open.

To test the effect of such treatment, one-half of a field was furrowed deeply and the other half ridged. The soil was in ideal condition, as regards moisture, during the preparation and the planting. A few weeks later when the first leaves were opening it became dry. It was then observed that, while the plants set in the deep furrows did not suffer very much, those in the ridges did so, and rapid yellowing and drying of leaves followed. Without irrigation,

planting in ridges is only advisable on low-lying grounds or boggy fields where the water table is so near the surface as to interfere with the perfect aeration of the soil. When ridged fields are well irrigated, very vigorous plants, bearing numerous, large tubers, may be produced.

An attempt was also made to conduct parallel cultures on new ground (previously in cogon) and on ground already in cultivation. Very few of the dasheens and gabis lived, because this field could not be irrigated during the dry season. Comparing the best plants of the two fields, it was seen that a distinctly greater yield was obtained from the new field. After the beginning of the wet season, the plants there compared very well in vigor with those of the irrigated field, being very green and enormous in size. It must also be taken into account that this ground had been a cogon area, only cleared at the time when the field was to be planted to this crop. In fact cogon was found in the same rows with the yautias where the cultivator could not root it out. It follows, therefore, that while other plants cannot thrive very well in patches of ground recently in cogon, the yautias will thrive there luxuriantly and produce abundant tubers, provided they be well irrigated.

It has already been stated that the yautias in the two lowest paddies were enormous in size, but produced comparatively few and small tubers. The tendency of these yautias was to produce very long and large madres. The gabis in this culture were very promising, but because of the wild hogs figures could not be obtained except for the dasheens. Although the soil, which during the planting was a mass of mud, packed very hard, the dasheens still formed tubers. In the upper paddies the yautias did not show vigorous development and did not form large tubers. There are dasheens that are well adapted to paddy planting, though generally the gabis are the best suited to the rice paddies. If irrigation can be kept up uninterruptedly till harvest, the water forms of the gabis should be chosen. If the field can be irrigated only to keep the ground in a proper state of tilth, the farmer should plant dasheens and yautias. The soil should not be so heavy as that used in this experiment, because it tends to bake hard during the dry season.

Planting in caiñgins, where the amount of shade is too great, and which have never been plowed and cultivated, is not an advisable practice. When the caiñgin prepared for this crop is quite open, however, and on rolling land where the soil is rather deep, a large crop of tubers may be expected. When the leaves are to be the marketed product, planting in the shade may be advisable, since the tendency of these plants under partial shade is to produce long petioles with large leaf blades.

SUMMARY

1. The ideal soil for the yautias, gabis and dasheens is deep, loose and friable, sandy loam being preferable with abundant moisture but not wet enough to interfere with proper aeration. In case the soil is too wet or the water at or very near the surface, planting in ridges is necessary.

2. Yautias and gabis should be planted during the season from January to March, or as early as the beginning of the dry season. If the planting is done during this season, the crop produced is large. Frequent and regular irrigation should be practised to insure success when planting is done at this season.

3. If frequent irrigation is impracticable, and planting is done during

the season from January to March, only the yautias should be planted, and they should be planted in deep furrows. The yautias are the most resistant to drought.

4. In rice paddies, if the water can be kept constantly flowing, the water forms of gabi may be planted; but if the soil be not too heavy, and the water only sufficient to keep the ground moist, the yautias and the dasheens are to be preferred to the water gabi.

5. Planting in deep furrows is more desirable than in ridges, in places where the water table is much below the surface and when frequent irrigation cannot be secured. Planting in ridges is better when the soil water is at or very near the surface.

6. Fertilization of yautias, gabis and dasheens is profitable on our soils.

7. Fields planted to these crops and irrigated during the dry season show very marked advantages over the fields not irrigated.

8. The upper portions of the madres in yautias and the central plants in gabis and dasheens, are more desirable for seed than smaller tubers. The larger tubers of yautias are also preferable to offshoots of the root-stocks.

9. For planting on new fields, especially on ground formerly covered with cogon and where other crops might, therefore, fail, the yautias are very desirable. Vigorous development, accompanied by a heavy yield, may be expected.

10. Planting as an intercrop, especially when the shade produced by the principal crop is dense, is not advisable. Although the plants may grow, few or no tubers can be harvested.

11. Caiñgin planting, except when nearly all of the shade has been removed and the land can be cultivated, is not advisable.

12. The gabis are very susceptible to root-rot, especially during the dry part of the year when the field is not properly irrigated. The taros are susceptible to the attacks of the sphinx moth larvae, the dasheens less so. Gabis are almost completely defoliated by these insects, especially during sunny days. The gabis are also preferred by aphids, although they do no great damage.

13. The yautias have been attacked by mealy bugs, although no appreciable damage has been observed.

14. In case a plantation is to be started in a place where wild hogs abound, the dasheens should be preferred to the yautias and the gabis, as these animals do not touch the former but have a liking for the two latter. In such places, fencing is absolutely necessary to the success of a yautia or gabi plantation.

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Acclimatization of Garden Peas

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INTRODUCTION

The introduction of garden peas into the Philippines involves acclimatization, that phase of agricultural development which has revolutionized the economic status of many regions. It is a fact that plants are not necessarily of largest economic importance in their original habitat, and they may turn out just as well, or better, in other places. Possibilities due to variation in response to a new environment are never lacking and these may lead to profitable results even in some cases where the crop is only of minor importance in its original habitat. Many of the staple crops now raised the world over have spread through a gradual process of acclimatization. Among these may be mentioned wheat, corn, potato, tobacco and coffee,—all of great commercial importance. Their dissemination has made and unmade industries, changed the course of commerce, and affected the industrial development of many communities. In general agricultural practice it is, therefore, a good policy to introduce all promising foreign plants. There are in this always possibilities of results which may lessen unnecessary importations and tend to make a country more fully self-dependent.

In the introduction of any foreign crop there are several factors to be taken into consideration. Acclimatization work requires experimental work that is too expensive for any private individual to undertake. The value of the crop, its importance, its prospect in the market and on the farm, are to be carefully considered before entering upon the work. In other words, its introduction must be justified. It was an open question therefore, whether peas, susceptible as they are to disease, and sensitive as they are to environment, would succeed generally in the Philippines, where many insect enemies and other pests exist and where the climate is entirely different from that of their original home. However, in cases of this sort, there is always the open possibility that among the many distinct varieties grown in other countries, especially in warmer sections, certain ones will be found capable of successful transferance to the new conditions, and able to withstand successfully all of the unfavorable conditions of the new region.

In the flats of the Mariquina Valley, in the province of Rizal, certain varieties of peas, evidently the same as the Chinese garden peas described in the *Cyclopedia of American Horticulture*, have been long under cultivation. The pea culture in the region is now passing the garden stage and has reached a considerable scale. In some parts of the valley, as in the town of the same name, large areas are devoted to the growing of peas. Recently the industry has been making great advances on account of the transportation facilities afforded by the railroad. Its cultivation has extended from the lower parts of the valley to the upper regions, not only on the loamy river flats but even on the terraced slopes of the adjoining hills, where the pea is grown under irrigation. The condition to which may be attributed the apparent success seen everywhere is the water supply, for there the water level is near the surface. The other climatic conditions are not far different from those in other sections of the country having marked seasons. The success of pea culture in this section has encouraged its introduction into other parts, as in the adjoining provinces of Laguna and Bulacan. Every year,

pea culture gradually extends from one town to another or from district to district. The Bureau of Agriculture is distributing seeds and the seed houses of Manila have ready a stock of peas. It can not be doubted that farmers are taking advantage of these agencies. Some farm schools are doing acclimatization work. In the 1914 Philippine Exposition some peas were exhibited from certain farm schools, but the best came from Baguio. These are positive indications of the practical possibilities of the pea in the market and on the farm, and justify every effort in comprehensive experimentation that may result in its more perfect acclimatization.

OBJECT OF THIS WORK

The object of the present work is to find out what varieties of peas can be adapted to local conditions, to ascertain in what seasons of the year they will grow best, and to undertake systematic selection and start pedigree cultures.

The general observations above given might be misleading. Some might conclude that any kind of peas would do well in any place in the Islands. The success of peas in the Mariquina Valley is but an incident occasionally met with in unsystematic acclimatization work. Two or three varieties are introduced and they respond to the environment. This is an exception. In going over the Experiment Station Records of the United States Department of Agriculture, we not infrequently find more failures than successes in lists of varieties tested. The College of Agriculture introduced, before this work was begun, varieties from regions the climate of which is more or less tropical. Seeds were introduced from Burma, Egypt, France, and even Baguio, but there are no plants or strains that remain from these earlier cultures. These failures at once proved the inadequacy of merely depending on a few varieties.

OUTLINE OF PRESENT EXPERIMENTS

The work begun at the College of Agriculture was intended to be quite comprehensive. All varieties were obtained from all available sources. The largest shipment was received September 17, 1913, from Haage and Schmidt, Erfurt, Germany, numbering 83 varieties in all. The work was begun with these together with a variety from Baguio and the first generation seeds obtained from a variety imported from Japan. Two varieties were received from Vilmorin-Andrieux et Cie., Paris, France. Later, by the middle of 1914, three varieties arrived from Calcutta, India. All the seeds used, therefore, were from Haage and Schmidt except $407F_2$, from Japan, and 2229, from Baguio; 1752, St. Desirat Mangetout; 1754, Brittany Mangetout, from France and the three from India, 2708, Champion of England; 2709, Early Morning Star; 2710, Ne Plus Ultra. The first planting was begun October 7, 1913, and continued till the first week of November. As first planned, seasonal plantings were to have been made every two months, to be made possible by repeated shipments of seeds. The seeds that were left over from the first planting in October and November, 1913, were found to be not sufficient for the work and besides, their vitality had been already weakened as found in germination trials made before the second seasonal planting on May 23 and 24, 1914. On June 25 and 26, another seasonal planting was made. On the breaking out of the European War in August, 1914, the plan had to be modified; for it was then impossible to get through further orders from Europe. The only hope for continuing the plan was based on the expected arrival of a shipment from the United States but this also had to be given up for none came before the end of the wet

season. The plan of bi-monthly plantings was, therefore, abandoned and the wet season plantings were simply checked by early dry season plantings in October and a final seasonal planting in December, 1914. The last was an entire failure for, except in a few varieties, no seeds germinated. The work then had to be concentrated on the seeds obtained from the first seasonal planting, which were hardly sufficient for complete experimentation. The selection and field plantings had also to be modified and delayed for causes that could not be helped. Only a few varieties of selected seeds were planted in October and November, 1914. The seeds had to be measured, weighed and recorded, and this took two weeks. When the seeds were ready the season was unfavorable, for during the first three weeks of November there was no precipitation. On the 15th of August, 25 varieties of the old seeds were tried in the coffee plantation.[1] This culture was entirely unsuccessful because of the too heavy precipitation there. Those seeds that germinated did not survive three weeks. On October 31st, 1914, 17 varieties were planted in the coffee plantation and check plantings were made at the same time on the College farm. The tail end of the typhoon in the Visayas on Thanksgiving swept the farm just in time to enable us to make all the necessary plantings that had been so long delayed. Sowing was pushed as quickly as possible during the first three weeks of December. Harvesting was begun in January. All of the last plantings that were made in December will not be ready for complete harvest till March, 1915. Eighteen varieties were planted on the summit of the First Peak of Mt. Maquiling on January 24, 1915. Plantings of the same were made on the College farm for comparison.

[1] This coffee plantation is on the side of Mt. Maquiling, at an elevation of about 1100 feet.

FIRST SEASONAL CULTURES

OCTOBER 7-NOVEMBER 11, 1913

The first cultures were located in the orchard on the north side of the College farm. The soil is clay loam. The trees were still seedlings, so they did not interfere with the amount of sunshine available. The ground was plowed deep, disked and harrowed until it was brought to a fine tilth. Some varieties, such as those from Baguio and Japan and some duplicates of other varieties, were planted in the trial beds that had been thoroughly spaded, forked and raked.

After the ground was well pulverized, it was marked in 1 meter squares and the lines thus made were followed by a furrower. Seeds were sown by hand, approximately one inch apart.

As the plants grew, the furrows were filled up gradually by a cultivator drawn by an animal in order to keep down the weeds, to keep the ground in good tilth, to allow free circulation of air, and to have a mulch of loose soil on the surface against rapid evaporation. The number of cultivations depended on the growth of weeds. To keep it in good tilth, cultivation only once a month was sufficient. The time for cultivation also depended on the weather, for proper cultivation can only be well done when the soil is not too wet and before it is too dry.

The initial cultures were planted from October 7 to November 11, 1913. The following were complete failures:

2004-Bohnenerbse
2007-Carter's First Crop (Sutton's Ringleader)
2008-Kapuziner (Tall)
2010-Autokrat
2014-Mark-Zucker (Sugar Pea, Wrinkled)

2030-Elefanten
2031-Little Green Late Pea
2032-Saxa
2033-Laxton's Vorbote (Express)
2058-Gold or Wachs
2063-MacLean's Little Gem
2064-Sunrise
2066-Triumph
2078-Wunder von Amerika
2092-William Hurst
2107-Buchsbaum No. 1, or de Grace
2229-Variety from Baguio.

The following of the first generation produced seeds and were considered then as promising:

407 F^2-Yitwentao (Japan)
2003 F Emerald Gem
2005-Braunschweiger grünbleibende Folger
2006-Prince Albert
2009-Alderman
2011-Wilhelm I
2012-Knights (tall, white)
2013-Early Wonder
2015-Zuckererbsen (holländische)
2016-Remontant (early, green)
2017-Schnabel or Sabel (flämische Riesen)
2018-Sabel
2019-Daisy
2020-Zuckererbsen (einblütige, früheste)
2021-Mammut
2022-Sensation
2023-Breton
2024-Wunder von Witham
2025-Buchsbaum, or de Grace
2027-Knights (dwarf, white)
2028-Senator
2029-Imperial
2034-Elefanten
2035-Abundance
2036-Laxton's Supreme
2055-Mai (earliest improved)
2056-Telegraph
2057-Schnabel or Sabel
2060-Gold or Wachs
2061-Bountiful
2062-Florentiner
2065-Sunrise
2067-Heinrichs (frühe)
2068-Buchsbaum Schnabel
2069-Daniel O'Rourke
2070-Remontant (early, white)
2071-Kentish Invicta
2072-Kron
2074-Automobil (Pilot)
2075-Kapuziner (dwarf)
2076-Laxton's Korbfüller
2079-Viktoria (Waterloo)
2080-Prince of Wales
2081-Dwarf Early Sugar Pea
2082-Champion of England (Erfurt)
2083-Ruhm von Cassel
2084-Beck's Gem or Tom Thumb
2085-Nero
2086-St. Martin, Winter
2087-Gradus (Ideal)
2088-Ruhm von Viety
2089-Butter
2091-Mai (dwarf early)
2093-Supplanter
2094-Stratagem
2095-Schwert
2096-Riesen-Schnabel
2097-Moerheims Riesen
2197-Nothung.

The results were excellent. It will be observed that the proportion of successes to failures was comparatively large, unusually large for a temperate crop newly introduced into a tropicalclime. 2008-Kapuziner and 2012-Knights (tall, reaching an average height of 1.3 meter and 1.5 meter respectively with excellent vegetative growth) might be utilized as a hay crop. The rest were then considered to be promising so far as seed production was concerned. The results cannot be taken as conclusive, because acclimatization reactions are extremely variable.

SUBSEQUENT CULTURE ON SLOPE AND PLAIN

The subsequent seasonal cultures were located in a new spot on the south side of the College Farm. This was formerly occupied by rice and rubber. It is in fact a slope on the southeastern extremity of Faculty Hill. Its topography allows two distinct types of culture—plain and slope—and every seasonal planting was thereafter distributed over both.

The plain culture occupies the lower part of the area which was spread out enough to present rolling and level ground permitting the free drainage essential to pea culture. The upper part of the slope was occupied by the slope culture. The ground is a gentle slope of approximately 15°. The cultures were separated by a space of 50 meters, making them quite distinct. The soil in both is loamy. On the northern part of the slope the soil is shallow, underlaid by stiff clay.

The treatment given these was essentially the same as in the initial planting. A point was made to have the furrows follow in general the contours of the place, such provision being necessary to prevent washing.

SECOND SEASONAL CULTURE
(MAY 23-24, 1914)

The second seasonal planting (the first in the wet season) was made on the 23rd of May, three days after the first rain, when the ground was mellow. Twenty-five seeds of each variety were planted by hand in rows one meter apart and twenty centimeters in the row, at a depth of five centimeters. Eighty-nine varieties were thus planted. This spacing was used to allow cultivation by animals and to give the plants all the chance possible. The germination was not encouraging. As soon as the seedlings began to come up above the surface rain came which lasted for a week. It was observed that on the southern part of the ground where the soil is compact and which did not permit of good drainage, the germination was low, most of the seeds rotting. On the southern part of the slope culture where the sub-soil is clay and heavy, the plants were weak and succumbed easily to sudden changes of weather. It was observed also that crickets and cockroaches were very active in cutting the tender young plants. In the first two weeks after germination many of the seedlings wilted and died. It was found that some were simply too weak for the heat and others had swellings in the roots caused by nematodes. The result was so discouraging that another wet season planting was made at the first opportunity.

THIRD SEASONAL CULTURE
(JUNE 25-26, 1914)

The second wet season planting was begun June 25. Here the disadvantages of the previous planting were avoided. Fifty seeds of each variety were planted in each culture. The spacing was the same and the depth of planting was about two and a half centimeters. This time, the result was more encouraging and there was a larger percentage of germination. There were losses due to root troubles and stem-cutting insects, especially black crickets. Lepidopterous larvae began to appear on the May plantings about the 26th of June and became very annoying. Plant lice appeared on one plant but did not spread. The cultivation was practically the same as in the first planting except that the hoe and rake had to be used between the plants in the row. Rapid growth of weeds necessitated biweekly cultivation. Weekly hand-picking of insects was necessary.

RESULTS.—The results of the wet-season experiments seem to prove that the pea is not fitted for the rainy season. Of all the varieties tested during the rainy season those that came out best were 2011-Wilhelm I, 2006-Prince Albert, and 2023-Breton. The last had a tendency to rankness but it did not fruit well. The varieties that reached maturity were stunted, the range in height being between fifteen and sixty centimeters. Only a few varieties succeeded in pulling through the season. There was a good number of varieties that flowered but they died after the September rains. Those that produced some seeds were:

2005-Folger
2006-Prince Albert
2011-Wilhelm I
2055-Mai (earliest-of-all improved)
2650-Chicharo
2013-Early Wonder
2546-Dickson's (früheste und beste)
1752-Saint Desirat Mangetout
2091-Mai (dwarf, early)
2023-Breton
2032-Saxa
2084-Beck's Gem or Tom Thumb.

The varieties from India gave the best germination, flowered within twenty days, but died without seed pods.

The rest succumbed to the sudden changes of the weather. It was observed that the continuous rains at the end of August and the beginning of September caused rotting of the flowers. The leaves and buds and even the pods also rotted. After the heavy rains, those that did not decay gradually dried up so that by the 15th of September, when normal weather came, all the surviving plants were dead. Thus, heavy rains do not favor pea growth.

FOURTH SEASONAL CULTURE

(October 23-24, 1914)

It was thought that the bad effects on the wet season cultures were aided by the age of the seeds. To decide this, check plantings for the previous October cultures were made on October 23 and 24, 1914. Half of the remaining old seeds numbering from 50 to 100 seeds of each variety, were planted in each culture, plain and slope. The cultural treatment was the same. The spacing between the plants was about 2½ centimeters. Only a few varieties germinated and the percentage germination was low in all. The drought that followed so badly affected many plants that they were stunted and given up as failures. The rain during the last week of November and first two weeks of December put new life into them. Those that survived began to grow luxuriantly.

These cultures showed the endurance of some of the varieties. No. 2055-Mai had fine germination, flowered in fifteen days and pods began to set, but due to the dry spell that followed the plants, except one in the slope culture, gave way, wilted and died. Even the rains could not invigorate those that were struggling. It was different with the other varieties. When the rains came, they were struggling and poor and had been given up as failures. But with the showers of November and December they revived and began to grow with great vigor. The average vegetative growth ranged from sixty to one hundred seventy centimeters. 2545-Pyramidal and 2546-Dickson's (Earliest) were peculiar. Some of them flowered early, and were dwarfed. These were only 17 centimeters high on the average and produced an average of two pods and three seeds. With the rains some of them attained fine vegetative growth. They were stouter and were three to five

times larger than those that succumbed. Their productivity was far higher, two plants of 2545-Pyramidal giving an average of 15 pods and 49 seeds, and three of 2546-Dickson's an average of 7 pods and 25 seeds. Those varieties from India had practically the same course. Many were stunted, straggling and bore no seed pods. There were some, however, which also took on rapid growth with the rains in November and December. 2708-Champion of England and 2710-Ne Plus Ultra produced good ripe pods but 2709-Early Morning Star died with young pods.

Aside from those already mentioned the most productive were 2091-Mai (dwarf), 2083-Ruhm von Cassel, 2006-Prince Albert and 2013-Early Wonder, in the plain culture. The last had the lowest average of the four but it gave the largest number of plants and had as highly productive individuals as the rest. In the slope culture 2013-Early Wonder gave the highest average and 2057-Schnable and 2023-Breton came second and third respectively. 2023-Breton in both cultures and 2073-Kron were rank. There were many plants that were rank but podless, as 2062-Florentiner (plain culture) and 2069-Daniel O'Rourke, which survived as late as March 1915 without flowering. 2070-Remontant and 3119-Chicharo were very tenacious, both surviving through the hot days of March when all the rest had dried out by the first week.

The Chinese variety that is raised in the Mariquina Valley, 3119-Chicharo, succeeded in weathering the dry spell also but only one plant succeeded in setting fruit, giving 15 pods and 36 seeds. Another planting of the same variety only produced two podded plants with an average of 4 pods and 12 seeds. These can not compare in productivity with several of the varieties in the fourth seasonal culture.

The results of the fourth seasonal culture conclusively prove that the poor vegetative growth and low production in the two preceding plantings, must be due to the wet season and not to the age of the seeds.

FIFTH SEASONAL CULTURE

(December 4-5, 1914)

This was the second dry season culture. All but a few of the seeds, left from the previous cultures, were planted. Although planted in the best season, when the showers were light and intermitting with sunshine, the germination was very poor. Those that germinated were the varieties that were received later from Haage and Schmidt. 2538-Telephon, 2545-Pyramidal, 2546-Dicksons (Earliest), and those from India, 2708-Champion of England, 2709-Early Morning Star, 2710-Ne Plus Ultra. All were dwarfed and slender and many died. 2545-Pyramidal and 2546-Dickson's produced from one to three pods with one to two seeds. Their heights ranged from 15 to 30 centimeters. 2709-Early Morning Star had twenty-five plants that succeeded in producing 41 pods, and had an average height of 26 centimeters. The plants from the remainder of the seeds from India were straggling and did not produce seeded pods. These results show that the first seeds lost their vitality and the varieties that came later from Germany and from India are not adapted to the late dry season.

This corroborated in a way what occurred in the stray plantings of December 29, 1913 of 2003-Emerald Gem and 2006-Prince Albert, which came out dwarfed and produced from one to three pods only. These same varieties had good vegetative growth and better production in the October plantings. It can not be said that the

seeds were too remote from the seeds that were first used, later plantings being made which gave as good results as the initial planting. The same can be said of the last series of selection plantings which were made during the second week of December, 1914, these being dwarfed and less productive.

MOUNTAIN CULTURES

To test the difference in the reaction of the pea to low and high land conditions, 18 varieties were planted on the summit of the First Peak of Mt. Maquiling at 1010 meters, and 17 in the coffee plantation. The climate is quite different from that of the lowland (College farm). There are no well marked seasons. Even during the hottest season of the year it is often covered with fog. It may be taken as having a continuous cool season, lying between the temperate and the tropical. The summit is in the heart of the mossy forest.

In contrast, the climate at the College farm has marked seasons—the wet and the dry. The wet season begins in June and ends by October; the dry season begins in November and ends in May. The following is the precipitation at the College of Agriculture:

Year	*Month*	*Rainfall*	*No. of days*	*Season*
1913	June	2.31 in.	8	Wet
"	July	16.62 "	27	"
"	August	8.72 "	28	"
"	September	11.79 "	18	"
"	October	6.85 "	12	"
"	November	3.70 "	16	Dry
"	December	3.87 "	20	"
1914	January	.61 "	8	"
"	February	.36 "	4	"
"	March	.17 "	5	"
"	April	2.77 "	7	"
"	May	3.08 "	10	"
"	June	12.11 "	19	Wet
"	July	5.97 "	22	"
"	August	8.36 "	20	"
"	September	26.65 "	20	"
"	October	2.33 "	16	"
"	November	3.02 "	14	Dry
"	December	2.18 "	16	"

The coffee plantation lies midway between the College of Agriculture and the summit of Mt. Maquiling. The climate is cool and the humidity is more or less constant. It was observed that from October to February, there was not a time when the soil became dry to a depth of more than 5 centimeters. In fact, the surface of the soil was moist even seven days after a rain while in the College at the same time the surface had dried up in two or three days. About half of the day the sunlight does not penetrate into the clearing. On the selected spots the sunlight does not fall until about 9:00 A. M. and the rays are cut off between three and four o'clock. This is due to the large surrounding trees and the ones left here and there in the clearing.

The planting trials were made at the coffee plantation on August 15th and October 31, 1914. One of the best lighted spots was selected for the preliminary planting on August 15. The soil is clay loam and somewhat sloping. The ground was loosened with a mattock and pulverized with a hoe and rake. Rows, 50 centimeters apart, were marked and the seeds planted by hand 5 centimeters apart. Three depths were used in planting:—5 cm., 2 cm. and 0.5 cm. Twenty seeds of each variety were used. A week later it was found that those at 5 cm. depth did not germinate as well as those at 2 cm. and 0.5 cm., only a scattering of the former coming out. Those that germinated did not survive two weeks for they rotted due to the heavy rains and too wet soil.

The second planting was made on October 31, 1914. Seventeen varieties from the first generation were used. Two cultures were made, in each of which fifty seeds of each variety were sown. Two spots were selected—one

in each of the two clearings—in the coffee plantation and another nearby clearing. In the coffee plantation the spot selected was the same as the one used in the preliminary planting. The other was practically level. The culture in the former was designated as the slope culture and the latter the level culture. The soil of the first is clay loam but the latter is darker and more compact forest loam soil, apparently having more vegetable matter. The cultural treatment of these was the same as in the preliminary planting. No cultivation was done except to remove the weeds.

The results from these plantings brought out interesting facts. The peas were apparently attacked by enemies different from those in the lowland. It shows that enemies can easily find the pea wherever it grows.

The growth of the pea in the coffee plantation is rank. The heights of the different varieties ranged from a maximum of 91 cm. in 2072-Laxton's Korbfüller to 253 cm. in 2006-Prince Albert. The productivity, however, was very poor; 2091-Mai (Dwarf, Early), the only variety in the midway cultures from which ripe seeds were obtained, had seven plants with eight pods having a total of fourteen seeds. Some scattering plants in every variety except 2003-Emerald Gem, which was a complete failure, produced from one to three pods but those that were ripening through the first three weeks of December rotted. The continuous wet condition of the soil, was not favorable to pea growth and the setting of fruit was handicapped. The rain caused the leaves and leaf buds to rot, especially those overlapping each other, or those covered with old leaves or sticks. Most of the ripening pods rotted also. This shows that peas cannot thrive in the shade and endure rain or moisture very long. It is suggested that peas planted in such places be trellised to prevent rotting. In the lowland cultures the growth was slower but the plants were stocky and productive.

All the seventeen varieties planted in these clearings gave fine germination results. There was none that gave lower than 50%. During the first ten days after the plants emerged from the ground, the growth was vigorous and excellent. The seedlings were stocky and looked very promising. The following weeks the shade began to tell on the plants. There was a rapid tendency to rankness, to run to vine, and to spindle, which was more marked in those plants in the more heavily shaded spots. On November 29, 1914, it was observed that the plants in the shady clearing were twice as tall as those in the open in the College garden. The second shoots of all the varieties, i. e., the shoots after the rotting of the old stems in December and January turned out to have strong, excellent growth. Most of these vigorous growths produced from one to three pods. 2197-Nothung had the strongest vegetative growth and best pods, 6 cm. long and 2 cm. broad, each with two to three large seeds. No ripe seeds could be obtained for by the end of January wild pigs began to eat the pods. The excellent, stocky growth after the germination and the strong second growth suggest that the pea might do well in the coffee plantation if the place were not so shady and wet.

LOWLAND CULTURE

(October 31, 1914)

As a check to the mountain cultures, the same varieties of peas were planted at the same time on the trial beds of the College garden. The cultural treatment was the same as in the selection cultures. The distance between the rows was 70 cm. and in the row 10 cm. The tall plants were trellised.

As has already been said, the plants on the College farm were smaller but more stocky. Their production was on the whole good considering the dry spell of November, the hot weather and the attacks of pests and insects. 2080-Prince of Wales had poor germination and had no fair chance to show up. However, what germinated was just as good in productivity as the best ones in the midway culture. The three that had the highest production were 2003-Emerald Gem, with an average of 8 pods and 20 seeds per plant, 2013-Early Wonder with an average of 7 pods and 16 seeds, and 2035-Abundance with an average of 9 pods and 15 seeds. Thus, on the whole, the lowland cultures turned out to be more productive than those on the mountain.

The results show the variable reaction of the pea to different conditions in different localities. In the mountain clearing, the shade and the heavy precipitation were unfavorable to pea culture. A later planting in December is recommended. In the lowland, earlier planting should be made in October or even late September. Planting late in December in the lowlands cannot be recommended on account of the hot weather, the necessity for irrigation, and the numerous enemies that are likely to appear in destructive numbers late in the dry season.

SUMMIT CULTURES

(January 24, 1915)

The same varieties, with the addition of 1869-Daniel O'Rourke, were planted on the summit of the first peak of Mt. Maquiling on January 24th, 1915. The planting was made later than was intended because the insect attacks on the College farm had to be attended to. A portion of the open space near the weather observation house, on the south side, was selected. The soil is a fine loam made porous by roots and other vegetable materials. In some parts it is underlaid to a depth of from 15 to 30 centimeters with brick-red soil—evidently of volcanic origin. The preparation of the ground was the same as in the midway culture. The rows were 50 centimeters apart and the plants 2.5 centimeters apart in the row.

A check culture was made about the same time on the College farm. The cultural treatment was the same as in the selection cultures. The distance between the rows was 70 centimeters and in the row 10 centimeters.

Growth started at about the same rate in both places but the second week the lowland culture was lagging behind and on the third was trying to catch up. Judging from the general stand of the different varieties, it is quite evident, that the summit cultures are stronger and faster in growth. The plants there are stockier so far, except those that are near the building and partly shaded by it.

FIELD TEST CULTURE

The farmers in the Mariquina Valley do not raise their own seeds. They prefer to buy the imported seeds from the Chinese seed dealers in Manila rather than to set aside plants for seed production. They say that it is not a good business proposition for they get more money by selling all the young pods than by letting them ripen for seed. This is a general practice which is not confined to peas alone. They simply compare the value of the pods and the seeds and conclude that the seeds from the same pods would bring less money. They overlook entirely a most common practice in scientific farming which has proved to be more profitable in the long run. They have not tried to determine whether the seeds raised by them on their own farms would produce more than what are

imported. If the seeds locally raised will not produce as much as, or more than, those from other places, then attempts to raise seeds for local planting are useless. It is one of the objects of this series of experiments to begin the work of weeding out the unadaptable varieties, and to ascertain those plants that respond best to local conditions. This work is undertaken in the field test cultures, where all the seeds from the initial cultures which were not used in other experiments were planted. Planting was made after the last seasonal culture. The spot selected for this planting is the space between the plain and the slope cultures in the rubber plantation. The cultural treatment was the same as in the seasonal plantings. The seeds were sown about 2½ cm. apart. The cultures went through a severe test. They were planted very late in the season at the end of the first December rains. There was some rain the last week of December, and from then on it was dry and hot. Some of the varieties were infested with mites and mealy bugs and affected by mildew. The plants were not irrigated; but in spite of all this, they emerged from the trying conditions and produced fairly well. Some of the varieties dried up by the end of February. All, however, succeeded in producing some pods. The seven most highly productive are compared with the first generation as follows:

AVERAGE INDIVIDUAL YIELD

Number	Variety Name	1914		1915	
		Pods	*Seeds*	*Pods*	*Seeds*
2089	Butter	2	5	5	15
2006	Prince Albert	2	5	4	13
2003	Emerald Gem	3	7	3	11
2011	Wilhelm I	3	6	3	11
2091	Mai (Dwarf Early)	2	4	3	10
2081	Dwarf Early Pea	2	5	3	9
2013	Early Wonder	2	3	3	9

The above shows that the second generation of plants produced more than the first. These results are indications of successful adaptation.

SELECTION CULTURE

College Garden

First Series

(October 10-November 3, 1914)

The most productive plants in each variety were selected from the initial cultures in 1913. The number set aside for selection work ranged from three to fifteen plants. Each plant was designated with the college number of the stock and a Roman number added to indicate its individuality. Thus, for instance, four plants were selected from 2011-Wilhelm I, then these were designated as 2011-I, 2011-II, 2011-III, and 2011-IV. The plants that came from the seeds of each parent, i. e., in the second generation, that produced any pods at all, were designated with the number of the parent with a cardinal number attached to distinguish it from the rest, this provision being made to enable us to make further individual selection. Thus 2011-I produced four podded plants and these were accordingly designated as 2011-II, 2011-II, 2011-III, and 2011-IV. In some varieties the unselected plants were separated in "poor" and "ordinary," and seeds obtained from these were designated with C (check). The vegetative growth, the branching and the production were recorded. The seeds from each plant were not all planted, some being left for future identification and some from the many-seeded ones were saved for future planting.

The selection planting were made on the test plots in the College garden. The soil is poor, having been continuously cropped without fertilization, for many years. The soil was pulverized fine by spade and fork and finished by raking. Furrows were made 70 cm. apart and the distance in the row was 10 cm. The depth of planting ranged

from 2½ cm. to 5 cm., depending on the condition of the soil, the less the moisture the greater the depth. The seeds were planted by hand. The first selection series was planted from October 10 to November 3, 1914. Further plantings were resumed in December. The first plantings were evidently growing slowly and many were dragging out a painful existence, through the drought. The plants revived and were wonderfully strengthened after the November and December rains.

Cultivation was necessary to keep off the weeds and to keep the ground in good tilth. In this work the hoe or the "Junior" hand cultivator was used, the latter preferred between the rows. The larger varieties were trellised.

Due to the drought in November, irrigation was resorted to in the selection plantings as many of the weaker plants were dying due to the heat and the shortage of moisture. The pouring of water on or around the plants was not practised for by this method the soil is baked, the water does not penetrate deep enough and the water that gets into the soil at all, is quickly evaporated due to the absence of mulch. The practice followed was to make a deep furrow with a hand plow not nearer than six inches to the plants and to run water into the furrow. Later when the water had sunk well, the furrow was covered by a hand plow or a hoe. It is a better practice to irrigate in the afternoon and then cover the next next morning, for in that case the water having been completely absorbed, a covering of the soil will give a better mulch. Two irrigations were made during November in the selection cultures. Irrigation was practised once a week regularly from January, 1915, in the cultures in the garden.

Besides the unfavorable weather conditions, the plants were infested by insects that ate the leaves and young pods. The last week of December while the writer was absent on a trip to the Mariquina Valley, mites, or "red spiders," appeared and spread rapidly in such numbers that they could not be immediately controlled. These apparently affected the growth and productiveness of the surviving plants.

The selection planting seems to show that selection based on the number of pods alone does not pay. The accompanying tabulations contain the data for those plants that bore pods. Of the first selection series from 407 to 2067 the following were entire failures:

407 F_2–I
2003–I, II, III, IV.
2005–I, II, III.
2006–I, II, III, IV.
2009–P. O. II, IV, VI, VII.
2011–III,IV.
2012–I, II.
2013–I.
2015–II, VI.
2016–I, II, IV.
2017–III.
2019–I, II, IV, V, VI, VII, VIII.
2021–C. I, II.
2022–I, III, V.
2023–I, II, III, IV, V, VI.
2024–I, II, III, IV, V.
2025–I, III, IV.
2027–C. II, III.
2028
2029–C. II.
2030–I, II.
2034–P. O. I, II, III, IV.
2035–I, II, III, IV, V, VI.

Yitwentao
Emerald Gem
Braunschweiger bleibende Folger
Prince Albert
Alderman
Wilhelm I
Knight's (tall, white)
Early Wonder
Zuckererbsen holländische
Remontant (Early green)
Sword or Beak
Daisy
Mammut
Sensation
Breton
Wunder von Witham
Buchsbaum or de Grace
Knight's (dwarf, white)
Senator
Imperial
Elefanten
Wunder von England
Abundance

2036–I
2055–I, II, III, IV.
2056–P. VI, VII, VIII, IX, X, XI.
2057–C. O. I, II, III, IV.
2060–I
2061–II
2063–I, II, III, IV.
2065–O. III. IV, V, VI, VIII, IX, X.
2066–I, II, IV, V, VI.
2067–I, II, III.

Laxton's Supreme
Mai (earliest improved)
Telegraph
Schnabel or Säbel
Fürst Bismarck
Bountiful
McLean's Little Gem
Buchsbaum Schnabel
Triumph
Heinrich's (frühe)

Second Series

Of the second series planted in December mere mention can only be made. Their vegetative growth as a whole is dwarfed and not up to the measure of the parents. Most of the plants are dying out, in spite of frequent irrigation. Even their productivity does not show any promise. These also prove the fact that planting late in the dry season is not favorable.

Test Planting

The few seeds of the other varieties that were not planted in the field test culture, were sown in the garden plots and were treated in the same manner as the selected seeds. The results are not yet available at this time. But it can be deduced from their general appearance that they are dwarfed and not well adapted to the late dry season. Many of the plants are dying out without even flowering.

SUMMARY

The poor results of the second and third, or wet seasonal cultures proves that the pea is not a rainy season crop. The results of the plantings from October to December were on the whole promising. The tenacity of some of the varieties and the general endurance shown in spite of the unfavorable conditions, pests and diseases, speak well for the future of peas here. The stray late plantings of the preceding year and all the later cultures—the last dry seasonal, and the late selection series,—all go to show that late dry season plantings are not advisable. The plants are dwarfed and besides this there are destructive enemies of the pea which appear in force in the dry season. Therefore, the planting should be made as soon as the wet season ends, after the heavy rains of September. It may be asserted that peas grow best when the rainy season is prolonged. It is evident also that the hot season is not favorable to peas. But the fact that in spite of the hot season and the drought, we succeeded in getting peas of fair productivity, indicates a fairly good prospect for the pea in the Philippines. Especially does it indicate the important prospect of being able to acclimatize a series of varieties that will make possible continuous plantings through a far greater portion of the year than is now possible.

According to the local climatic conditions of the College of Agriculture farm, the season that can be so far considered as best adapted to pea growth, begins with the first week of October and ends with the second week of December, provided that there be no long drought, or prolonged heavy rains. It is possible to make earlier plantings—as early as the middle of September.

The mountain cultures indicate that the pea is at home in cool regions, or high altitudes. Experiments made with more materials will surely bring out more positive results. The midway cultures might have given more successful results if it had not been for two unfavorable conditions—shade and too wet soil.

The results of the early seasonal cultures from October to December

show that there are many varieties that might be adapted to local conditions. 2006-Prince Albert, 2011-Wilhelm I, 2013-Early Wonder, and 2091-Mai (dwarf, early) have so far shown to be the best adapted to local conditions at the College of Agriculture. 2013-Early Wonder is the one that has responded most uniformly well.

It may be mentioned here that to meet the demands of the local markets, there are varieties that are still promising. From 2062-Florentiner in the first selection planting some fine seeds were obtained and 2097-Moerheim's Riesen is good. These have tender, fine pods with a breadth of 2 to 2½ cm. and a length ranging from 7 to 10 cm. It may be remarked that the farmers in the Mariquina Valley do not raise the hard-shelled varieties, for, as they say, the consumer prefers those that are crisp. On that account the large crisp-podded varieties from France should also be introduced. If, however, peas are ever extensively grown here for dried peas, some of the hard-podded varieties will be used for general agricultural practice and canning.

In the October plantings and in the first selection plantings, it was observed that the flowers that were formed late and those of the late shoots after the main harvest, did not produce good pods, or if they did at all, they had few or poor seeds. In some cases the plants simply dried up with all the young pods. This indicates that the plants would not give a profitable yield after the main harvest and the ground can be better used than for other purposes. In any case, the plants, if not used for forage, should be plowed under in preparation for plantings in May.

There is a factor in pea culture which will vitiate all results of acclimatization if allowed to have its own course—that is pests and diseases. The enemies are too numerous to be overlooked. They must be attended to from the start before they spread in such numbers that they cannot be controlled. The fact that the cultures in the College garden were more badly infected, suggests that plantings should be made where the possibility of infection is least. The garden has been planted at different times with a variety of vegetables and other plants, foreign and indigenous, and these have attracted and concentrated the insect forces and other pests. It is suggested that new ground should be preferred for pea culture and rotation should be practised.

CONCLUSIONS

1. Many varieties of peas can be introduced into the Philippines.
2. There are many varieties of very varied characters and values that are adapted to Philippine conditions.
3. The pea is not a wet season crop.
4. It grows best at the period of transition from the wet to dry season, especially when light rains continue.
5. Late dry season plantings are not recommended.
6. The pea is at home in cool regions.
7. The pea runs to vine in shaded places.
8. Early plantings in the dry season are recommended in order to avoid the worst attacks of destructive dry season pests.
9. Selection by the number of pods alone is apparently not productive of results.
10. Peas, as grown in the Philippines, show a very wide range of individual character and performance, and thus will furnish good material for seed selection.
11. Acclimatization work, in order to get more comprehensive results, must be carried out at many places in these Islands.

Acknowledgments are made to Prof. Baker for advice and guidance; to Mr. Elayda for help in the field work; to Dr. Gates for weather observations; and to Miss Mary Polk, Librarian of the Bureau of Science, for assistance in reference work.

Current Literature

PIRACY ON THE SPANISH MAIN

(*From the Louisiana Planter, August 12, 1916.*)

"In days of old, when knights were bold and pirates held their sway, at least when Morgan displayed his piratical strength on the Spanish main, in those days, now nearly three hundred years ago, it was quite the fashion to take things that did not belong to one and to do it without compensation or consideration to the rightful owner.

"We were somewhat surprised to note in that handsome Havana daily paper *El Mundo*, published in Spanish in Havana, under date of July 31, an article under the title of 'Como Cuba Próspera Rapidamente,' which article was published originally in *El Mundo Azucarero*, the Spanish edition of *The Louisiana Planter*, on page 373 of the July issue, which came out July 1st. The copying of the article is verbatim, excepting the change in the title.***

"We must be polite and in considering the matter seriously we know that this excellent Spanish journal had no intention of copying this article verbatim from our columns without the change of a word or a punctuation point, and not crediting it to us. They have simply omitted by accident the fact that the article was taken from *El Mundo Azucarero* and inadvertently put another title to it. Of course we enjoy the high appreciation of our own work that is thus indicated by this accidental inadvertency of our Spanish confrere in Havana, and would say to the editor of that excellent journal that he is welcome at all times to take from our columns all the data that would benefit his journal and benefit Cuba, but for Heaven's sake, he must follow the accepted newspaper ethics of the world at large and give the journal from which the article is taken due credit for the same.***

"We are willing always to do all we can for the common good and our confreres in Havana are welcome to use all they wish out of our colums, but we must insist that they give us due credit for the same.

In its issue of August 26, two weeks after the righteous wail just quoted, *The Louisiana Planter* publishes, "verbatim from our colums without the change of a word or a punctuation point, and not crediting it to us," Segundo Labayen's graduation thesis on sugar manufacture at the Calamba Sugar Estate, published in THE PHILIPPINE AGRICULTURIST AND FORESTER, Vol. IV, page 92. "Of course we enjoy the high appreciation of our own work that is thus indicated by this accidental inadvertency of our Louisiana confrere, and would say to the editor of that excellent journal that he is welcome at all times to take from our colums all the data that would benefit his journal and benefit Louisiana, but for Heaven's sake, he must follow the accepted newspaper ethics of the world at large and give the journal from which the article is taken due credit for the same."

Of course, there is an alternative possibility. *The Louisiana Planter* might have received an identical contribution from some source beside THE PHILIPPINE AGRICULTURIST AND FORESTER. However, we are quite unable to entertain the suspicion that the editor of *The Louisiana Planter* is ignorant enough of the current literature on the topic to which his pages are devoted to permit the perpetration of such a hoax.

Still we are tempted to quote from *The Louisiana Planter*, this time from the issue of September 2, 1916.

"* * * We believe that Louisiana has develop as fine, or finer, cane culture than is practised elsewhere in the cane sugar world.

"We do not now recall any sugar cane experiment station work wherein the progress of the growth per day or week or month has been recorded, and it would seem to afford an excellent opportunity for some research work in that direction. By its means the growth of sugar cane per week could be identified with the rainfall in the same locality per week and the whole season of active growth thus coming under careful observation, we might find that certain varieties of cane grew more rapidly under given conditions that other canes, all of which would gradually lead to the utilization of the most successful and doubtless the best types of cane for our various soils and conditions. Sugar planters have at times marked a given point on the growing end of the sugar cane by tying a string around it and by driving a stake alongside the cane of the same height as mark. This would give the growth per day or per week, or per month of the single instance under observation. If the work were carried on more extensively we would likely find the greatest growth of the cane in the periods of the greatest amount of sunshine and that cloudy days would give less active growth."

We take it all back about the difficulty of hoaxing the editor.

COCONUT DISEASES IN THE SALEIER ISLANDS

Bulletin No. 21 from the Laboratory for Plant Diseases of the Department of Agriculture Industry and Commerce of the Dutch Indies, just received, deals primarily with a disease of bananas in the Saleier Islands, but contains information with regard to other crops. This little group of islands is immediately south of the south end of Celeves. The insect pests reported are the Oryctes beetle and a louse, identified as *Aleurodicus destructor Mackie*, hitherto definitely known only from the Philippines. The latter has done serious mischief on several of the islands, resulting even in the killing of a number of trees. Its destructiveness is confined to the dry season. *Pestalozzia palmarum* is reported as damaging the leaves to a serious extent on one of the Islands. There was also found on the Island of Poelasi, and reported from Kajoeadi, an unknown coconut disease, locally known as "poeroe-poeroe", meaning pockmarked which results in the production of very much stunted nuts. The attack seems to be confined to the individual nuts, but the responsible organism is undertermined.

The banana disease is serious enough to destroy whole fields. The responsible organism is unknown, but the disease seems to be quite distinct from the bacterial disease reported from Panama and neighboring lands.